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ABSTRACT

A limitation of most past studies of university environments is that they have been restricted to institutions in the United States. Accordingly, in this study two approaches to the measurement of environments were applied to Japanese universities: factor analysis and classification of faculties according to the Environmental Assessment Technique (EAT) scheme. Four factors were interpreted to involve Size, Affluence, Technical Emphasis, and High Cost - Private Control. The EAT profile scores are closely tied to theory, appear to reveal meaningful differences in emphasis by Japanese universities on subject matter areas, and are related in meaningful ways to the factor environment measures. Thus, both procedures yielded results that are reasonably clear and meaningful. Moreover, the pattern of these results is generally similar to the pattern of results in the United States, but with differences that appear related to the organization of higher education in the United States. (Author)

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A STUDY OF THE "ENVIRONMENTS" OF JAPANESE UNIVERSITIES

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Abstract

A limitation of most past studies of university environments is that they have been restricted to institutions in the United States. Accordingly, in this study two approaches to the measurement of environments were applied to Japanese universities: Factor analysis and classification of faculties according the the Environmental Assessment Technique (EAT) scheme. Four factors were interpreted to involve Size, Affluence, Technical Emphasis, and High Cost-Private Control. The EAT profile scores are closely tied to theory, appear to reveal meaningful differences in emphasis by Japanese universities on subject matter areas, and are related in meaningful ways to the factor environmental measures. Thus, both procedures yielded results that are reasonably clear and meaningful. Moreover, the pattern of these results is generally similar to the pattern of results in the United States, but with differences that appear related to the organization of higher education in the United States.

A STUDY OF THE "ENVIRONMENTS" OF JAPANESE UNIVERSITIES

James M. Richards, Jr.[1]

American Institutes for Research

The problem of how to characterize the environments of colleges and universities has been approached in a number of different ways. Student responses to questionnaires have been used as sources of information about the environmental "press" of the college (Pace and Stern, 1958), features and facilities of the campus (Pace, 1963), or observable characteristics of the college that potentially can change the sensory input to students (Astin, 1968), Factor analysis of data obtained from compendia and other public records has yielded summary statistical descriptions of colleges (Astin, 1962, 1965; Richards, Rand, and Rand, 1966, 1968). Still another approach is the Environmental Assessment Technique and its derivatives, which grows out of Holland's (1959, 1966a) theory of personality and occupational choice. This approach assumes that a socio-psychological environment is a function of the dominant personality types of the people who compose it, and accordingly classifies such people in terms of six personality types or "personal orientations": Realistic, Investigative[2], Artistic, Social, Conventional, and Enterprising. Some investigators (Astin and Holland, 1961) have classified students in terms of these orientations while other investigators have classified faculties and curricula (Richards, Seligman, and Jones, 1970; Richards, Bulkeley, and Richards, 1971).

A limitation of these studies is that they have been restricted almost entirely to colleges and universities in the United States. Yet,

universities exist in almost all nations of the world, and presumably have purposes and characteristics that transcend national differences in politics, economic systems, religious orientations, etc. To place these studies in a broader context, therefore, it would be useful to have information about the extent to which the techniques found useful for describing colleges and universities in the U. S. also yield meaningful results when applied to institutions of higher education in other countries. As a first step in providing such information, the present study applies some of these techniques to the description of Japanese universities.

Universities in Japan offer some unique advantages for such a first study because after World War II the occupation forces revamped the entire Japanese university system, consciously following the U. S. model (Inatomi, 1967; Shimbori, 1967). On the other hand, Japan has its own tradition of higher education, and apparently had at least one institution recognizably a university (Umene, 1967) that was established about three hundred years before the University of Bologna, perhaps the first true university in the West (Haskins, 1962). Moreover, investigators from the United States who draw conclusions about Japan with no special knowledge of and experience in that country are likely to make gross (and sometimes offensive) errors and misinterpretations (Johnson, 1971). Therefore, the imposition of these procedures developed for U. S. universities on Japanese universities to some degree smacks of intellectual arrogance.[3] In defense, it can only be said that any genuine advance in knowledge requires some degree of intellectual arrogance, and that only the subsequent usefulness of any given study determines whether it is a genuine advance in knowledge.

The basic source of data was the International Handbook of Universities, 1968 (International Association of Universities, 1968). It is not entirely clear what criteria determined inclusion in this compendium, but it appears that any Japanese institution that would be classified as a junior college (or "Tanki Daigaku") was not included. Such colleges, of course, are a significant part of the Japanese higher education system (Watanabe, 1967). But, even in the United States four-year colleges have been studied much more than two-year colleges, and only recently have techniques been developed that potentially could provide a common framework for the study of the environments of both two-year and four-year colleges.

This compendium lists some 316 institutions of higher education. But, sufficient data for inclusion in the factor analysis were reported for only 124 of these institutions. It is important, therefore, to determine the biases in the sample of institutions with useable data. Table 1 summarizes results for a two-way classification (public vs private

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Insert Table 1 about here

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and has graduate school vs no graduate school). The variation shown in Table 1 is highly significant (Chi Square = 59.91, df = 3. This Chi Square, of course, is based on frequences, not per cents.). Consequently, it seems clear that the results are biased against smaller institutions with no graduate school, and that among such institutions the sample is further biased against private colleges. It must be remembered, however, that in multi-college studies in the United States somewhat different results

have been obtained depending on whether the sampling of institutions attempted to be representative of the population of colleges or representative of the population of college students. This situation should also apply to Japan, and the present sample of colleges should be much more nearly representative of the population of Japanese college students.

Two different approaches to the analysis of these compendium data were used: factor analysis and classification of faculties according to the EAT scheme. The method and results for each approach will be described separately.

Factor Analysis

Method

Twenty-one institutional variables were selected for study. The choice of variables had two primary aims: first, to include as many variables as possible that would be comparable to variables used in similar factor analytic studies in the United States, and second, to have a reasonably comprehensive summary of the published data about Japanese universities. The description of these variables follows:

1. Private vs Public Control - Public score 0; private score 1. No distinction was made between national and other public universities.

2. Religious Control or Training - Universities controlled by religious bodies or offering religious training scored 1; other universities scored 0. No distinction was made between different religions.

3. Liberal Arts Emphasis - Universities offering liberal arts training scored 1; other universities scored 0.

4. Engineering Emphasis - Universities providing training in engineering scored 1; other universities scored 0.

5. Education Emphasis - Universities providing training in education scored 1; other universities scored 0.

6. Medical Emphasis - Universities providing training in medicine, dentistry, or veterinary medicine scored 1; other universities scored 0.

7. Fine Arts Emphasis - Universities providing training in the fine arts scored 1; other universities scored 0.

8. Graduate Emphasis - Universities providing graduate training scored 1; other universities scored 0.

9. Tuition - Score is yen per annum.

10. Enrollment - Score is the total number of students, excluding external students.

11. Growth Rate - Percentage of increase in enrollment between the 1962 and 1968 editions of the International Handbook of Universities (International Association of Universities, 1962, 1968).

12. Per Cent of Males in the Student Body.

13. Per Cent of Foreign Students in the Student Body.

14. Faculty Size - Number of full-time faculty members.

15. Per Cent of Full Professors on Full-Time Faculty.

16. Faculty-Student Ratio - Number of full-time faculty members divided by total number of students.

17. Library Size - Score is total number of books in the library.

18. Books Per Student - Score is total number of books divided by total number of students. In studies in the United States, this variable was called "Relative Library Size".

19. Number of Faculties - Score is the total number of separate faculties, such as liberal arts, engineering, science, etc.

20. Number of Institutes - Score is the total number of research and other institutes attached to the university. Examples are Institute of Brain Research, Theoretical Physics Research Institute, Institute of Business Research, etc.

21. Age - Score is the number of years between founding of the university and 1970. This variable is complicated by the post-war reorganization of Japanese universities by the occupation forces. As a consequence of this reorganization, many universities are listed as founded in 1947, but with an earlier "original" founding date. In such cases, the investigator judged as well as he could the date on which an institution with some continuity under a title comparable to the present title was established. Obviously, therefore, this score may be somewhat imprecise.

In spite of the prior selection of universities on the amount of information published in the compendium, some missing scores occurred. Because the computer factor analysis program did not allow for missing data, it was necessary to substitute some value for missing scores. After examining the actual numerical values for various alternatives, it appeared that the most reasonable substitute value on a given variable for a given university would be the median on that variable for universities in the same cell of a two-way classification. This classification involved public vs private universities and universities offering graduate training vs universities that do not offer such training. Such substitution for missing data may bias results in unknown ways. However "Growth Rate"

is the only variable with enough missing scores to make the possibility of such bias a serious concern.

The next step was to transform scores on each variable separately to stanine scores (Guilford, 1956 , p. 503). Conversion to stanines is a normalizing transformation. Next product moment correlations were computed among the 21 variables. The resultant correlation matrix was factored by the principal axes method. For each variable, the diagonal value was the squared multiple correlation between all other variables and that variable. The "Scree Test" for discontinuities in the curve of eigenvalues (Cattell, 1966) suggested that four factors should be retained in the final solution. Accordingly, the correlation matrix was re-factored by the principal axes procedure, using as the diagonal value the communality of each variable computed from the first four unrotated factors. Four factors were extracted and rotated to a final solution by the Varimax procedure.[4]

Results: the rotated factor matrix is shown in Table 2.

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These rotated factors are briefly described and interpreted below:

Factor A

The variables with high loadings on this factor describe universities with large enrollments, faculties, and libraries. They also have a large number of separate faculties and institutes. The obvious title for this factor, therefore, is Size. The high scoring university also is more likely to offer graduate training and training in liberal

arts, engineering, education, and various medical fields, and has relatively many foreign students. Comparable Size factors were obtained in studies of four-year colleges (Astin, 1962) and two-year colleges (Richards, Rand, and Rand, 1966) in the United States.

Factor B

Loadings on this factor describe universities which have high faculty-student ratios, a large number of books per student, and a relatively small number of full professors. They are also more likely to offer training in medical fields. A good title might be Affluence. Again somewhat similar factors were obtained in studies of higher education in the United States. Results differ from those obtained in the U. S., however, in that the high scoring institution is more likely to be public than private and does not have a high tuition.

Factor C

Universities characterized by the variables loading high on this factor have relatively many male students, offer training in engineering, and have no religious affiliation or training program. An obvious title would be Technical Emphasis. Highly comparable factors were obtained in the studies of colleges and universities in the U. S.

Factor D

The high scoring university is characterized primarily by high tuition and private control. Accordingly, an appropriate title might be High Cost-Private Control. Other loadings describe a university with low faculty student ratios and books per student, no training in education, and somewhat higher growth rates and proportions of full professors. A factor was obtained in the study of two-year colleges in the United States

that was subsequently reinterpreted as involving High Cost (Richards, Rand, and Rand, 1966, 1967). That factor differed from the factor obtained in this study, however, in that it had more loadings on variables tapping facilities per student.

To summarize, the goal of this factor analysis was to provide a brief statistical summary of information which can be used to characterize Japanese universities. It appears that this goal was attained, for the original 21 scores were reduced to four factors which seem reasonably clear and easily interpreted.

Classification of Faculties According to EAT Scheme

Method

The basic procedure was to estimate the number of faculty members falling into each of the six types in Holland's theory (1959, 1966a). This procedure assumes that personality type and occupational choice are related in approximately the same way in the United States and in Japan. More specifically, it is assumed that, say, agricultural workers and lawyers differ in roughly the same ways in the two countries. No definitive evidence on the correctness of this assumption is available. However, Holland's personality typology is based mainly on such characteristics as preference for dealing with things, persons, or ideas; emphasis on concrete vs abstract thinking; and the like. Therefore, it seems plausible that the general principles of his typology, although perhaps not all the specifics, will apply to any industrialized country.

In similar studies of colleges in the United States (Richards, et. al., 1970, 1971), the department to which a faculty member belonged determined his type. The International Handbook of Universities, however,

lists only the number of members of various faculties - such as the faculty of engineering, medicine, or fine arts - schools, colleges, and institutes. In such cases as the faculty of agriculture, education, or music, Holland's (1966b) empirical classification leaves little doubt about the appropriateness of assigning all members to an appropriate type. Difficulties arise for complex faculties, such as a faculty of liberal arts, or for a faculty combining two types, such a faculty of economics and social science. In such cases, the faculties were distributed to two or more personality types according to a weighting scheme. The major elements in the weighting scheme for the distribution of faculties falling into two or more types are shown in Table 3.

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Insert Table 3 about here

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The major cases not shown in Table 3 are faculties combining two types. In such cases, if title included both types such as Faculty of Economics and Social Science, 60% were assigned to the first type and 40% to the second type. If one type was only listed as "included", for example Faculty of Economics (including Social Science), 90% were assigned to the first type and 10% to the second type.

These weights were chosen on the basis of Holland's (1959, 1966b) overall theory and empirical classification, and of overall impressions gained from similar studies of colleges and universities in the United States(Richards, et. al., 1970, 1971). Moreover, an attempt was made to use conservative weights in the sense that a higher proportion of a given faculty was assigned to the dominant type for that faculty than

appears to be the case in the United States. Nevertheless, it is clear that these weights introduce yet another element into this study that is somewhat arbitrary. It is felt, however, that any other weighting scheme that is reasonable in terms of Holland's typology will be fairly close to this weighting scheme, and that results obtained with any other reasonable weighting scheme will differ from this study only in details, not in overall pattern.

In accordance with the procedures used in studies in the United States (Richards, et. al., 1970, 1971), the scores were converted to normalized standard scores with a mean of 50 and a standard deviation of 10(Guilford, 1956, pp. 494-501). To permit estimation of the relative emphasis on each type, the total distribution was transformed rather than making a separate transformation within each type.

The six transformed scores for an individual university comprise a profile. Like all profiles, it can be analyzed appropriately in terms of three components: elevation, scatter, and shape (Cronbach and Gleser, 1953). Elevation is simply the mean of the scores comprising the profile. In this study, elevation should reflect mainly the size of the college. Scatter is proportional to the standard deviation of the profile scores, so in this study the standard deviation was used as the measure of scatter. Universities with low scores have faculty members distributed relatively evenly across the six types. Consequently, scatter resembles the measure "homogeneity" derived from EAT (Astin and Holland, 1961). Shape is measured by the six type scores for a given university after those scores are equated for the university mean and standard deviation.

In the present study, therefore, two sets of profile scores were examined: (a) the original profile of six type scores for each university, and(b) the transformed profiles consisting of elevation, scatter, and the six type scores converted within universities to standard scores with a mean of 50 and a standard deviation of 10. The statistical analysis of these profile scores involved computation of means and standard deviations on the scores across all universities, and correlation of the profile scores with estimated scores on the four factors obtained in the first part of this study.

Results

The means and standard deviations for the profile scores are shown in Table 4. These results suggest that in Japan, as in the United

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States universities, faculties emphasize some personality types more than other types. For both original and transformed profiles, the difference between the highest and lowest means exceeds one standard deviation. Thus the profiles appear to reveal differences in relative emphasis on subject matter areas. In comparison to institutions of higher education in the United States (Richards, et. al., 1970, 1971), Japanese university faculties seem to emphasize Realistic more and Artistic less. Moreover, these appear to be genuine findings, for any bias in the weights shown in Table 3 probably militates against such findings.

The next step was to correlate the various profile scores with estimated scores for each university on the four factors obtained in the

first part of this study. Estimated factor scores (on a scale with mean = 5 and standard deviation = 2) were computed from two-variable multiple regression equations using factor loadings as the validities.[5] The specific variables were chosen for high loadings on the appropriate factor, and for independence. For example, engineering training was not used in estimating factor scores because having an engineering faculty contributed to the computation of the profile scores. For the Size factor, the variables used in the estimation equation were enrollment and library size; for Affluence, the variables were faculty-student ratio and per cent of full professors; for Technical Emphasis, the variables were per cent male students and religious control or training; and for High Cost-Private Control, the variables were tuition and private control. The multiple correlations between the estimated scores and the corresponding factors were .89, .85, .76, and .88, respectively. Thus, reasonably accurate estimates were obtained for each factor.[6]

Table 5 shows the correlations between the estimated factor scores and the various profile scores. In interpreting these correlations,

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Insert Table 5 about here

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it must be remembered that not all of them are completely independent because the six transformed scores are ipsative. In general, these correlations are consistent with the construct validity of both sets of scores. More than half of the correlations are significant, and each environmental measure is correlated with several profile scores.

The largest correlations are those for profile scores that involve university size (elevation and the six original profile scores). Other correlations are generally similar to the corresponding correlations obtained in the United States. The major exception is that Enterprising has a moderate positive correlation with Affluence in the United States and a moderate negative correlation with Affluence in Japan.

To summarize, the profile scores are closely tied to theory, appear to reveal differences in emphasis by Japanese universities on subject matter areas, and are related in meaningful ways to other measures of the university environment. Therefore, such profile scores appear promising for the study of the environments of Japanese universities. The profile scores used in this study could be improved, however, by a data source that provided a more detailed breakdown of faculties in terms of chairs or disciplines.

Discussion

This investigation was intended primarily as a first stop in providing a wider context for the measurement of university environments. More specifically, the goal was to explore the extent to which some of the procedures used in research on college and university environments in the United States are also useful for research on college and university environments in other countries. With respect to this goal the results appear quite encouraging. Both of the procedures applied to the measurement of Japanese University environments (factor analysis and classisfication of the faculty in terms of the EAT scheme) yielded results that were reasonably clear and meaningful. Moreover, the pattern of thses results was generally

similar to the pattern of results in the United States, but with differences that appear related in meaningful ways to the organization of higher education in Japan.

It should be noted, however, that a number of compromises were necessary concerning the data included and the treatment of these data. These compromises seem justified for a first study, but any future investigations of Japanese Universities certainly should seek for more complete and comprehensive sources of data so that fewer such compromises would be required. In the same connection, all of the data analyzed in this study can be classified as "Non-reactive" (Wobb, Campbell, Schwartz, & Sechrest, 1966). It would be very interesting, therefore, to know the relationships between these measures and a "reactive" measure of the environments of Japanese Universities, such as a Japanese instrument similar to CUES. Similar considerations would apply to the measurement of university environments in other countries.

One methodological point should be mentioned, since it may be general rather than specific to this study. This concerns the analysis of profile scores into the components of elevation, scatter, and shape. Rather than making such an analysis, Astin and Holland (1961) in their original EAT study simply computed the per cent of cases falling into each type. Such per cents have some undesirable properties for computing correlations with other measures of the environment, however, and profile analysis was intended to avoid some of these undesirable properties. But, it is common to have a number of colleges with no faculty members falling into one or more types (especially Conventional). When scores are transformed to standard scores <u>within</u> colleges, wide variation in the standard scores for a given type may occur among colleges all of which had no faculty members falling into that type. Indeed, it is possible for a college with an above average (for all

colleges) number of faculty members falling in a type to have a lower within college transformed score for that type than a college with no faculty members falling in that type. To say the least, such side effects produce problems for interpreting comparisons among colleges. Because some control for size is essential, no completely satisfactory solution to these problems is immediately apparent. One approach to solving them, however, would be to return to the original Astin and Holland procedure of computing the percent of cases in each type. Some other transformation could then be applied to such percents to yield scores more suitable for computing correlations with other measures.

TABLE 1

Per Cent of Various Types of Institution
With Sufficient Data For Inclusion

	Included	Not Included
Public, With Graduate School	63.4%	36.6%
Private, With Graduate School	63.0%	37.0%
Public, No Graduate School	30.4%	69.6%
Private, No Graduate School	17.9%	82.1%
Total	39.2%	60.8%

Note - Rows add to 100.0%

TABLE 2

Varimax Rotation of Four Principle Axes

	A	B	C	D	
	Size	Affluence	Technical Emphasis	High Cost-Private	h^2
1. Private Control	-.04	-.38	-.28	.82	.89
2. Religious Control or Training	.09	-.23	-.54	.17	.38
3. Liberal Arts Training	.53	-.25	-.41	-.26	.58
4. Engineering Training	.50	-.03	.48	-.20	.52
5. Training in Education	.42	.17	-.06	-.55	.51
6. Medical Training	.29	.69	.27	.03	.64
7. Fine Arts Training	-.07	-.04	-.15	.09	.04
8. Graduate Training	.54	.32	.23	.18	.49
9. Tuition	-.04	-.12	-.10	.86	.76
10. Enrollment	.82	.33	.29	.08	.88
11. Growth Rate	-.07	-.32	-.17	.28	.21
12. % Male Students	.13	-.07	.65	.09	.45
13. % Foreign Students	.35	.20	-.03	-.02	.16
14. Faculty Size	.74	.38	.27	-.29	.85
15. % Full Professor	.00	-.72	-.05	.21	.56
16. Faculty-Student Ratio	-.08	.84	.01	-.43	.89
17. Size of Library	.79	.12	.14	-.29	.74
18. Books Per Student	.02	.55	-.17	-.52	.60
19. Number of Faculties	.85	.06	.07	-.26	.80
20. Number of Institutes	.69	.12	.06	-.04	.50
21. Age	.33	-.09	-.03	.06	.12

TABLE 3

Major Elements in Weighting Scheme for Distribution
of Faculties Falling Into Two or More Types

Faculty:	Realistic	Investigative	Artistic	Social	Enterprising	Conventional
*Letters, Liberal Arts, General Education, or Arts		.20	.75	.05		
Humanities			1.00			
Liberal Arts and Science		.40	.55	.05		
Engineering	.80	.20				
Science and Engineering	.40	.60				
Business, Commerce					.90	.10
Computer		.90				.10
Law and Letters			.10		.90	
Social Science and Liberal Arts			.45	.55		

*If a separate science faculty is also listed, however, no members of this faculty were classified as Investigative. Similarly, if a separate social science faculty is listed, no members were classified as Social. Rather, they were classified as Artistic.

TABLE 4

Means and Standard Deviations for
Profile Scores

	Mean	S.D.
Original Profile		
Realistic	51.08	10.09
Investigative	55.41	9.87
Artistic	52.10	7.96
Social	51.09	7.20
Enterprising	48.51	8.06
Conventional	44.07	3.42
Transformed Profile		
Elevation	50.38	5.36
Scatter	6.60	2.15
Realistic	50.27	10.04
Investigative	56.28	9.41
Artistic	53.67	8.78
Social	51.58	8.58
Enterprising	48.20	8.94
Conventional	40.66	5.65

TABLE 5

Correlations Between Profile Scores
and Estimated Factor Scores

	Size	Affluence	Technical Emphasis	High Cost-Private Control
Original Profile				
Realistic	.63**	.21**	.44**	-.42**
Investigative	.51**	.47**	.32**	-.21**
Artistic	.63**	-.14	-.19*	-.10
Social	.53**	.14	-.22**	-.44**
Enterprising	.72**	-.35**	.21**	.13
Conventional	.55**	-.41**	.18*	.24**
Transformed Profile				
Elevation	.87**	.08	.21**	-.26**
Scatter	.27**	.65**	.26**	-.36**
Realistic	.22**	.24**	.51**	-.37**
Investigative	.01	.50**	.24**	-.08
Artistic	.00	-.28**	-.53**	.17
Social	-.19*	.10	-.55**	-.27**
Enterprising	.27**	-.52**	.21**	.38**
Conventional	-.59**	-.10	.03	.35**

* p < 05
**p < 01

Note- Scores within transformed profiles are ipsative, so significance tests are not independent.

Footnotes

1. Requests for reprints should be sent to J. M. Richards, Jr., American Institues for Research, P.O. Box 1113, Palo Alto, California 94302.
2. Originally called "Intellectual."
3. A particular problem for this study is that the author has never seen a Japanese university. Having no particular objection to being an "airport scholar" part of the time, however, he would be happy to remedy this deficiency in his qualifications.
4. A Promax oblique rotation differed very little from the Varimax rotation. In particular, the hyperplane counts were increased only slightly.
5. Tables showing the estimated factor scores and the profile scores for the individual universities can be obtained by writing to the author.
6. However, such estimated factor scores are more correlated across factors than would be factor scores computed using all variables.

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